



# Transforming IT Into Innovating Together



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NASA, Jet Propulsion Laboratory,  
Caltech  
**February 2011**

***“One must learn by doing the thing;  
for though you think you know it, you have no certainty until you try.” - Sophocles***

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# Agenda

- Does IT matter today? Tomorrow?
- What are the IT industry trends and how can you benefit?
- How will IT be redefined and what can you do?
- How can these examples of Innovating Together help your organization?
- Yes, IT is all about you!



***“Those who have knowledge, don’t predict. Those who predict don’t have knowledge.”***

***- Lao Tzu, 6th century B.C.***





# JPL is part of both NASA and Caltech

- JPL is a Federally Funded Research and Development Center (FFRDC) Managed by CalTech for NASA
- NASA's lead center for robotic exploration of the solar system. Have 19 spacecraft and 9 instruments across the solar system and beyond
- \$1.7B contract per year, ~ 5,000 employees; 177 acre facility located in Pasadena, CA, with 670K sq.ft of office space and 900K sq.ft. of labs

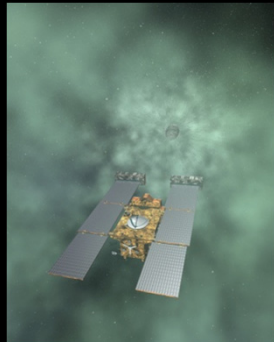


- Manages worldwide Deep Space Network
  - 3 Locations - Goldstone CA, Madrid Spain, Canberra Australia
  - Spacecraft Command & Control - Recording scientific data
- 50+ years experience in spacecraft design, production, operation
- JPL spacecraft have visited all planets in our solar system except Pluto!

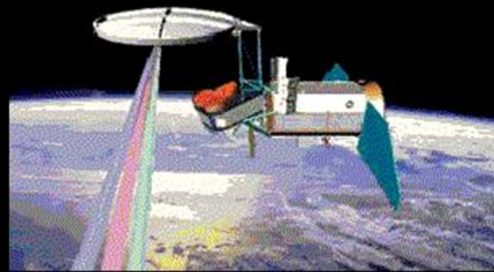
# Upcoming Mars & Solar System Exploration Events



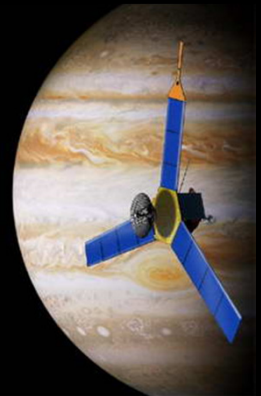
EPOXI  
Comet Flyby  
November 2010



Stardust- NExT  
Comet Flyby  
February 2011



Aquarius  
April 2011



Juno  
August 2011



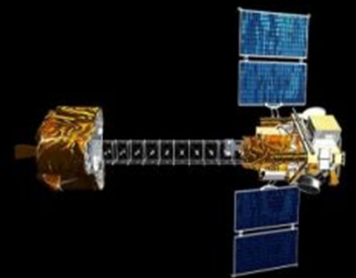
Dawn Vesta Arrival  
August 2011  
(Ceres, February 2015)



GRAIL  
September 2011



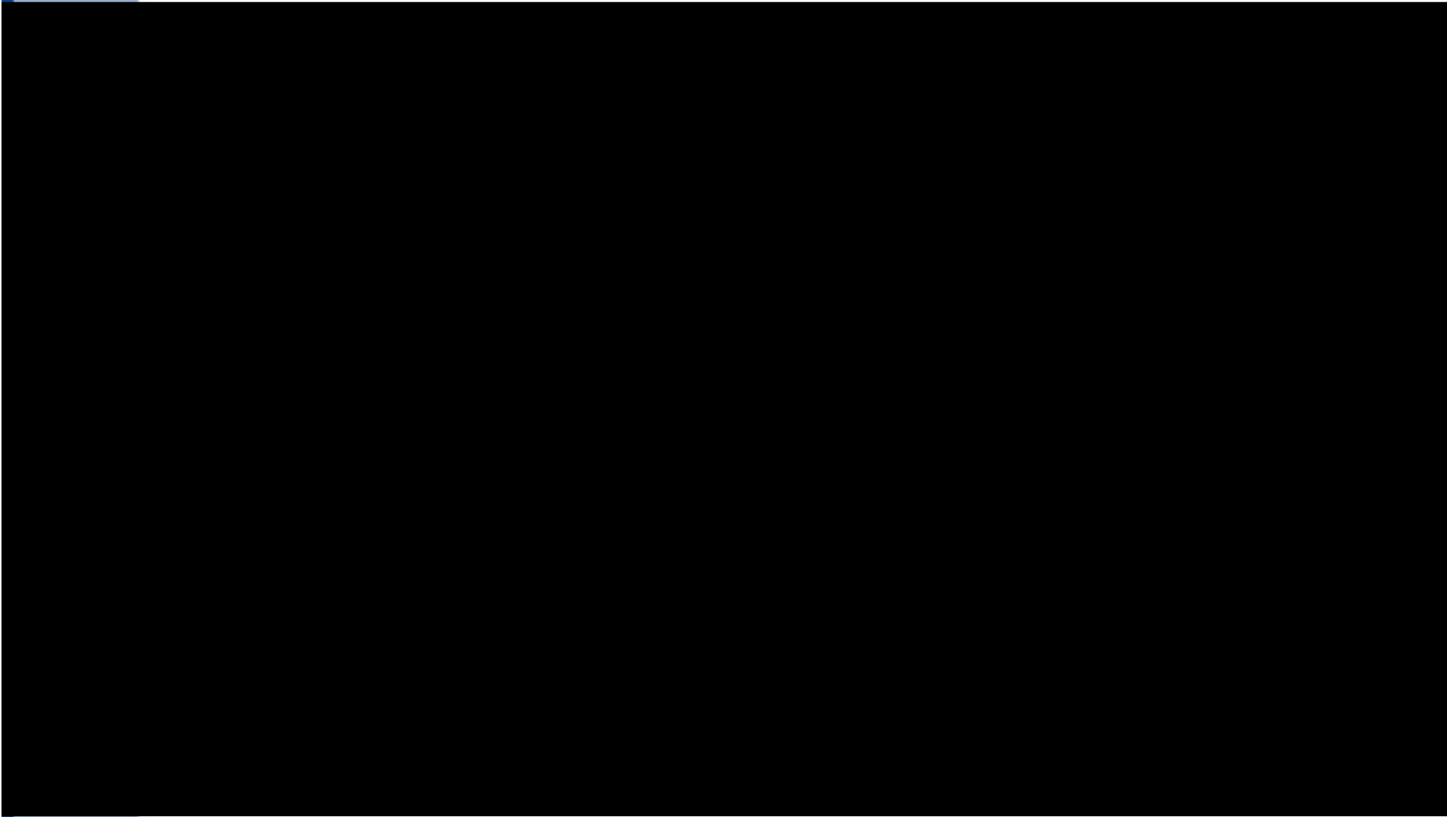
Mars Science Laboratory  
November 2011



NuSTAR  
January 2012



# See Comet Hartley 2 up close



# Remember when...

This meant portable?



This meant mobile?



This meant  
connected?



***“640K ought to be enough for anybody”  
- Bill Gates, 1981***

***“The aeroplane is scientifically impossible.”  
- Royal Society president William Thomson,  
1897-9***

- 3 years ago we realized issues with stove piped IT, duplicate IT, IT that “didn’t matter”, obsolete IT, and IT that we had to support alone. What should we do?



# Focusing on IT trends in 2008 paid dividends

*It gave NASA/JPL employees influence over and early access to relevant technology that improved their productivity and satisfaction*

A few examples:

- IT customers gained early advantage of Consumer Electronics via the Technology Petting Zoo, prototypes, and working groups
- New smart phones with mission focus
- Use of Remote Face to Face systems (HD video conferencing)
- Early knowledge and use of cloud computing
- Help to steer the IT ship via ITLabs, IT working groups, IT boards
- Outreach and collaboration in virtual NASA Centers such as “Explorer Island” and missions in virtual worlds
- Social Networking – Twitter, Facebook, etc.
- Ability to upload/find/view videos via JPLTube
- Enhanced partnering via the Superpartners program

*So, it was worth doing it again...*

# How did we arrive at the new IT Trends?

We did a lot of proactive research

We talked with many CTOs, engineers, futurists, and technology and business leaders. Some examples include:

- **Thinkers:** Gartner, MIT, Forrester, Ziff-Davis, Leading Edge Forum, Burton Group, magazines, books, conferences
- **Partners and leaders:** Lockheed-Martin, CSC, NASA, FFRDCs, Deloitte, A.T. Kerney, BAH
- **Startups:** Large and small and very small
- See backup slides for their detailed predictions

So, what did we find?...

# JPL IT Trends 2011 and Beyond

## Mega trend:

Work with anyone from anywhere with any data using any device

2008

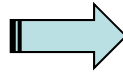
### Top IT Trends affecting JPL

1. Extreme Collaboration
2. Cloud Computing
3. Go Green
4. Cyber Security
5. Consumerization of IT
6. More Resources
7. Develop Differently

*Removed for 2010*

*Modified for 2010*

*New for 2010*



2011 and beyond

### Top IT Trends affecting JPL

1. Extreme Collaboration Made Simple
2. The Pervasive Cloud
3. Eco Friendliest
4. Refocused Cyber Security
5. Consumer Driven IT
- ~~6. More Resources (removed)~~
6. You've got apps
7. Immersive Visualization and Interaction
8. Big Data
9. Human Behavior

## Mega results:

→ Transforming IT into “Innovating Together”  
by fostering the ingenuity of the IT consumer



# INGENUITY

Because One Just Isn't Enough



# Impact to society and your business

- How are your expectations changing? Your kids'?
- How will the evolving computing help us at work?  
In our daily life/projects? In our social life? On the go?
- How much privacy will you give up for convenience?
- SmartPhones + SmartTVs + SmartCars → **SmartPeople?**
- Will Moore's Law apply to people?
- We already talk differently

*Are you on linked in?*

*When did you last google yourself?*

*Is your mom your friend?*

*Are you following me?*

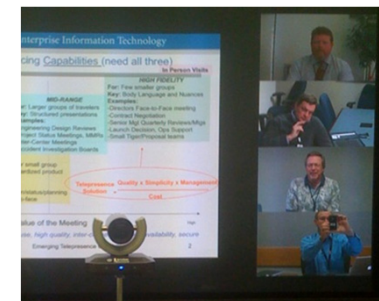
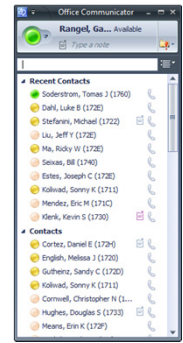
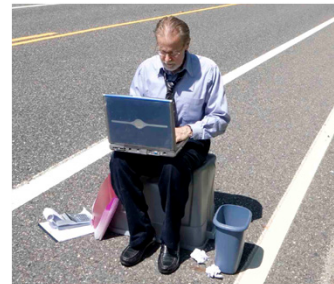


*How will our children  
speak?*

*Will they  
communicate  
better?*

# Trend 1. Extreme Collaboration Made Simple

- Knowledge Sharing
- Social Networking
- From anywhere with anyone
- Real-time Content Creation
- Face to Face(s)
- Cloud based
- Super Partners
- Physical / Virtual Worlds



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*“Everything that can be invented has been invented”*  
 - Charles Duell, Commissioner, US Office of Patents, 1899



# Early IT Examples: Knowledge Sharing



Dashboard > JPL Wired > ... > Hardware Assembly and Testing

Browse > [Log In](#)

> Drop Tests



## Drop Tests

+ Add > ⚙ Tools >

8 Added by [Mark Yerdon](#), last edited by [Randall West](#) on Jun 30, 2010 ([view change](#)) [show comment](#)

A **drop test** is performed to simulate the entry, descent, or landing ([EDL](#)) of a spacecraft to the surface of a planet. This can include testing systems such as the mobility at touchdown, airbags, crushable features, and release mechanisms. High speed cameras and accelerometers are often used to record the test article's dynamics during the drop.



### Content

- 1 [Method of Drop](#)
- 1.1 [Test Location](#)
- 2 [Test Equipment](#)
- 2.1 [Drop Article](#)
- 2.1.1 [Scaling](#)
- 2.2 [Impact Surface](#)
- 2.3 [Attenuation](#)
- 2.4 [Lifting Device](#)
- 2.5 [Release Mechanism](#)
- 2.6 [Data Acquisition and Instrumentation](#)
- 2.6.1 [Cameras](#)
- 3 [Safety](#)



Second Life → First Life

IT Experiments

Petting Zoo

Ideas



1 Rating(s)

### JPL Text Messaging Service

An internal JPL Text Messaging Service would pr employee or contractor that has their cell phone



1 Rating(s)

### JPL Open Space

JPL Open Space would be the integration of JPL development drives innovation and influence be open source development within JPL by any JPL portfolio.

06-2



2 Rating(s)

### LDAP-driven badge readers

Let's make the access lists for badge readers an process of granting people access and enable us



### Paystub export

In the "JPL View Payroll Check Stub" tool, there personal financial software, by exporting the dal

ITLabs

### Newest Videos on JPLTube

Sort Videos - Switch to List View (1 - 12 of 284) Next >

<p><b>The Nasa Chronicles - In Orbit</b> No Ratings Margulies, Isaac A (172E-Affiliate) 00:20:50 07/13/2010</p>	<p><b>Timelapse of the Station Fire ...</b> No Ratings Margulies, Isaac A (172E-Affiliate) 00:00:12 07/13/2010</p>	<p><b>The Final Hubble Servicing Ma...</b> No Ratings Margulies, Isaac A (172E-Affiliate) 00:14:30 07/13/2010</p>	<p><b>Roll Control System Installed ...</b> No Ratings Margulies, Isaac A (172E-Affiliate) 00:14:41 07/13/2010</p>
<p><b>STSS Launch</b> No Ratings Margulies, Isaac A (172E-Affiliate) 00:02:29 07/13/2010</p>	<p><b>Opportunity on Mars</b> No Ratings Margulies, Isaac A (172E-Affiliate) 00:12:01 07/13/2010</p>	<p><b>Mars Science Lab</b> No Ratings Margulies, Isaac A (172E-Affiliate) 00:10:41 07/13/2010</p>	<p><b>Orion FTA</b> No Ratings Margulies, Isaac A (172E-Affiliate) 00:08:41 07/13/2010</p>
<p><b>Atlantis Shuttle Launch</b></p>	<p><b>NASA DreamTime</b></p>	<p><b>NASA JPL Phoenix</b></p>	<p><b>Ares Rocket Update -</b></p>

JPLTube



## Trend 2. The Pervasive Cloud



➔ Cloud is THE enabler... if we continue to Keep it Real



# *IT Example: Use Cloud for Citizen Science*

<http://BeaMartian.jpl.nasa.gov>

*Reaches MS Cloud developers / citizen scientists of all ages*



## *JPL IT Cloud Example: Amazon HPC usage for Athlete*





## *What's next for Clouds and Clouds at JPL?*

- We learned from cloud trials with Amazon, Google, Microsoft, CSC/Terremark, LM, etc and will expand them. Great ROI.
- We transition from understanding the Cloud to working in the Cloud to partnering in specialized Clouds
- The Cloud enables everything ... if we let it (e.g. PC 3.0)
- Specialized Clouds become the Operating System
- JPL will advance the Cloud Readiness Levels (CRL) and Cloud Oriented Architecture (COA)
- Spin the Wheel of Security and evaluate more Use Cases
- Automate the Cloud Application Suitability Model (CASM)
- Continue to keep it real and benefit from employees' and partners' ingenious usage of Clouds

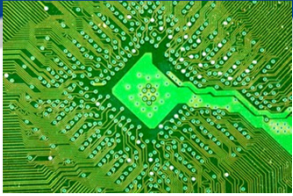
**Take full advantage of the Pervasive Cloud**

*Use the Cloud for Redundancy*





## Trend 3. The Eco Friendliest



Multicore

- “Will the real Eco Friendliest please stand up?”
- Changes how we select and measure technology including purchases, **source selection, compliance, stature in the community with IT leadership**
- Show energy usage prominently in realtime in your building or on your project
- Will go from interesting trend to corner stone with 
- “Green Tsars” galore
- We must extend beyond the 2% solution



Green Dashboard

# Trend 4. Refocused Cyber Security

- Trends: Less control + increased regulation  
+ more attacks + increased awareness →
- Need faster solutions despite new challenges:  
Cloud Computing,  
Mobility,  
Personal devices,  
Collaboration,  
Social Media,  
International hacking,  
Increased partnering
- Cyber security goes from afterthought to front:
  - “The buck starts here”
  - “Protect by enabling”
  - Partner with IT Security on your project



# Trend 5. Consumer Driven IT

- Increased personal stake in devices & capabilities
- Huge mobile improvements – hardware, software, bandwidth. E.g. Near Field Communication (NFC) and Bling
- Everything is wireless (e.g. HDMI, HD sound, HD video)
- We all pick - everyone gets involved with technology application evaluation and selection
- Open Source (Linux → Android → ?) (e.g. POX)
- End users Ingenuity becomes the killer app (e.g. ITLabs becomes an ingenuity platform where you benefit from end users ingenuity)



Smart phones



# IT Consumerization Trends 2010

## 1. The Cloud



## 2. eReaders



## 3. "Eco friendly"



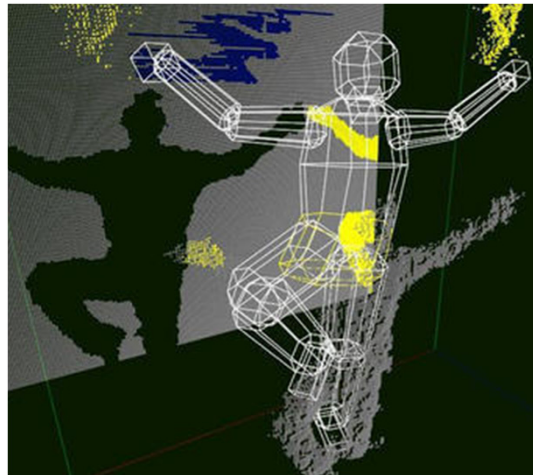
## 4. Media Convergence



## 5. Visualization



## 6. Gaming



"NUI"

## 7. Increased, powerful mobility

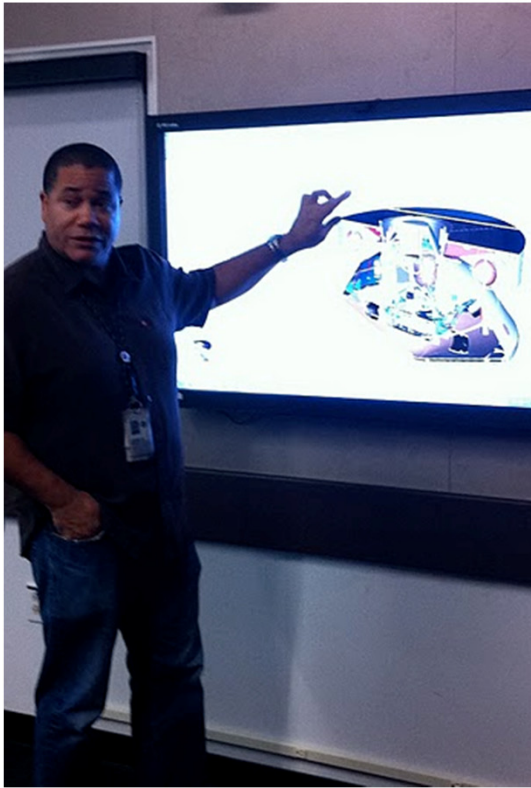


# “IT” on Consumerization Trends 2010

1. **eReaders** → Kindle, iPad, eBooks, Hub
2. **Eco friendly** → Partnered with JPL Green Club, IT enabled sensors
3. **Mobility** → iPhone, iPad, Droid, App Store, JPL Apps
4. **Media convergence** → Small, wireless projectors, collab Ctrs
5. **Gaming** → MS Kinect in Ops Lab, BeAMartian Mobile on WP7
6. **Cloud** → Cloud WG, JPLTube, Thin Client Prototype
7. **Visualization** → Augmented Reality prototype, Mechanical Design Center (3D projector, multi-touch displays, virtual SmartBoard, Video Conferencing), Left Field, MS Surface Table in The Hub

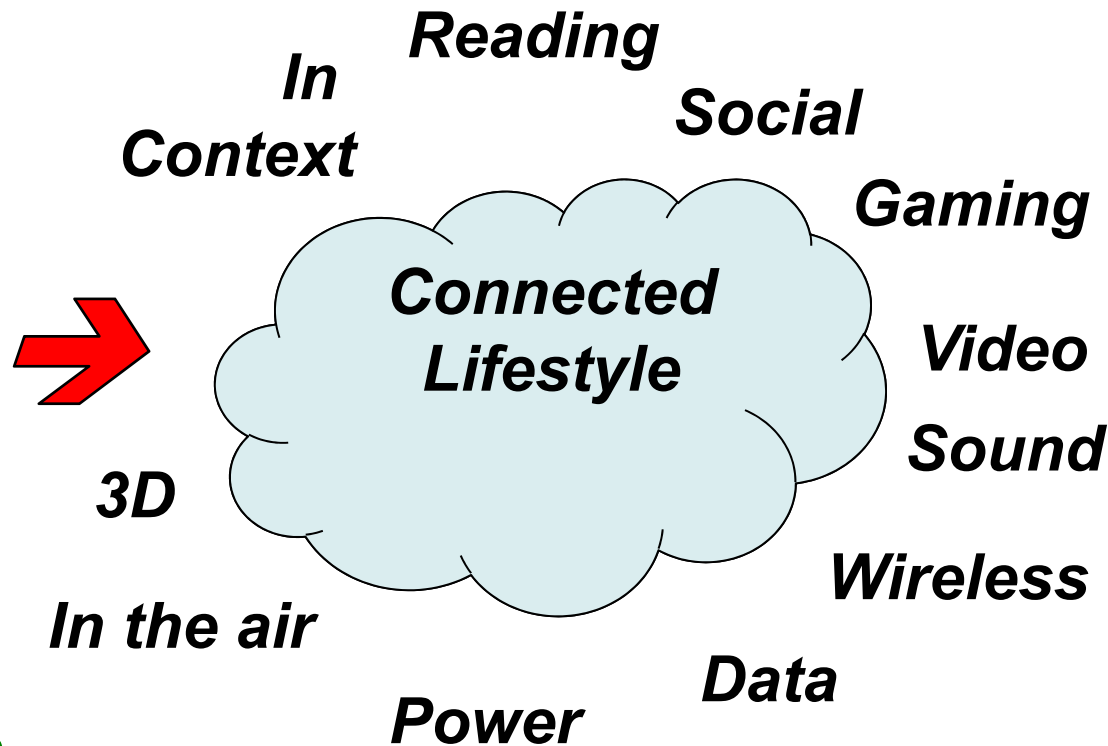


# Innovating Together: Distributed Petting Zoo



# CES 2011 Summary

*Always On*



*Easy*  
*Anyone*  
*Anytime*  
*Anywhere*  
*Any device*  
*Any content*  
*Any form factor*

***Drag + Drop + Sync + Share***

# Key CES 2011 Key Trends

1. **Smart Connectivity** – devices, content, people
2. **Powerful Tablets** - everywhere
3. **Android Everywhere** – in phones, tablets, cars...
4. **Smart Power** - Portable, alternative, monitored  
... at home, in the office, on the road
5. **Natural User Interface in action** –  
via multitouch, voice, in the air, 3D everywhere)

**Start Innovating Together on these trends now.  
It's affordable and effective... and fun.**

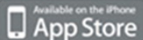
# Trend 6. You've got apps

- Growth of Apps. Downturn in Programs
- Develop for the Cloud and mobile
- Increase in Social Networking and Semantic Web with lots of linked data
- Build so it can be mashed up by others
- Web becomes the operating system
- HTML5 becomes THE standard
- Support Self-support
- Rethink your development/support strategy



## Space Images iPhone App

Stunning images of stars and planets -- including Earth! -- are at your fingertips with Space Images from NASA's Jet Propulsion Laboratory. JPL's Space Images iPhone app, which hosts hundreds of images taken by spacecraft studying Mars, Saturn, our solar system and beyond, is now available for free in the iPhone App Store. Find it by typing "JPL Space Images" into the App Store search bar.

 Available on the iPhone App Store [Go directly to iTunes](#)



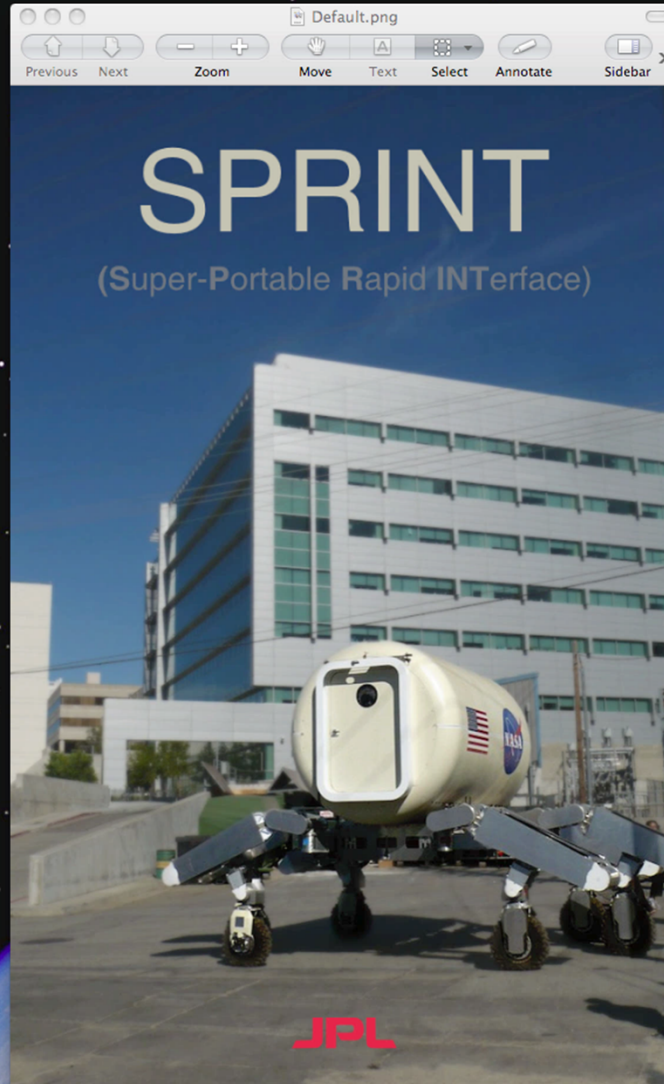
# IT Example: Driving Robots



*Nick,  
JPL Student*



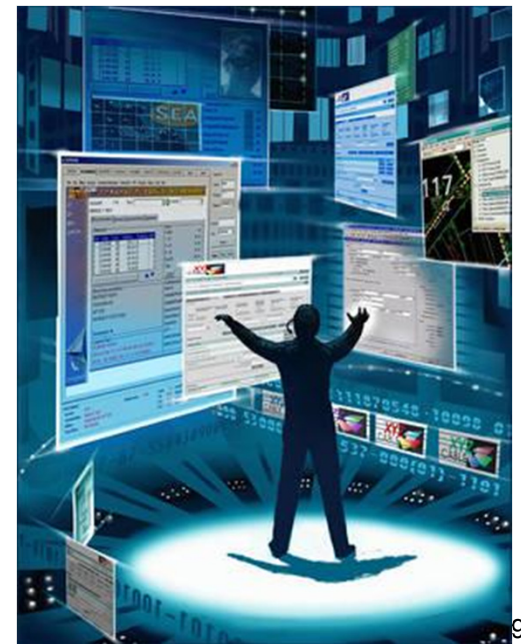
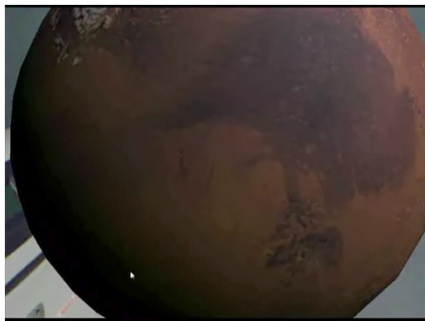
*David,  
JPL Student*





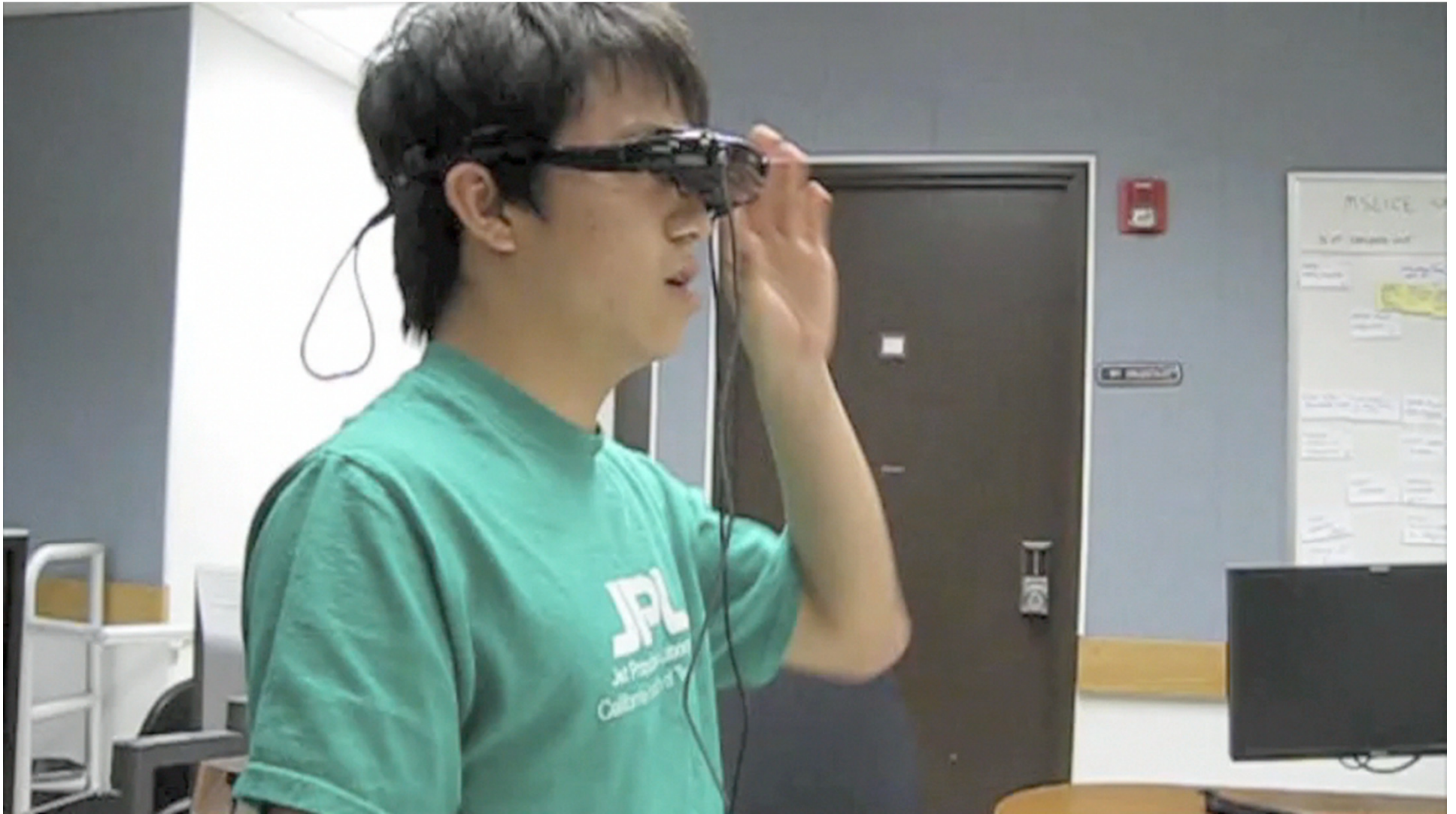
# Trend 7. Immersive Visualization and Interaction

- Natural User Interface (NUI)
- Multi-touch
- Visual Thinking
- 3D everywhere
- Augmented Reality (A/R)
- **Rethink your users' interface, data access, and interaction**



*New thinking for NUI: <http://10gui.com/video/>*

## IT Example: Review of the Future

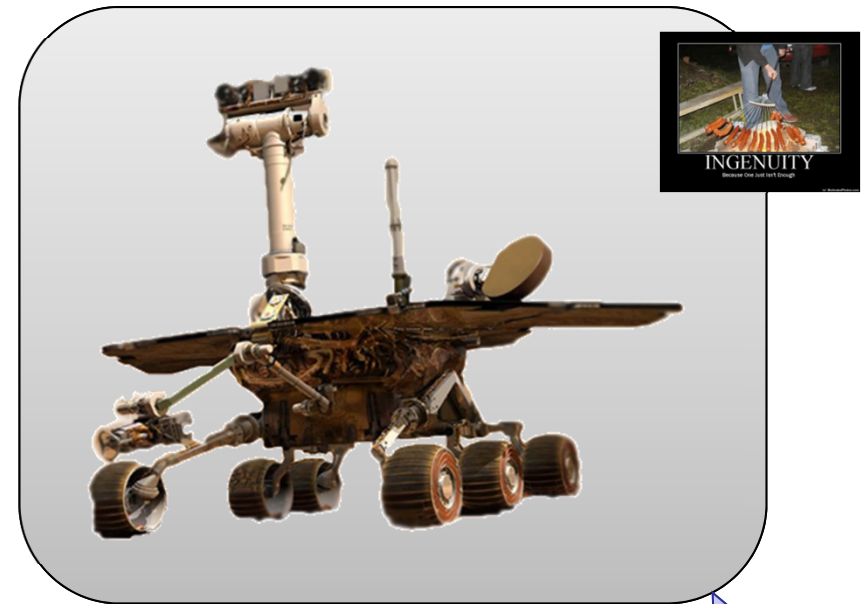


*James, JPL Intern*

# IT Example: Increased efficiency through visualization

- An intuitive, multitouch, NUI could be used to find huge amounts of data without even having to type a single word by zooming (in the same way you do on an iPhone) into the areas you were looking to find information about (ie: Rover wheel)
- It would tap, real-time, into the existing silos of information that already exist on lab

*Multitouch NUI display*



Bottom line: Increased visualization capabilities means  
we get more done in less time

Mark Rober  
Mechanical Engineer  
JPL Division 35

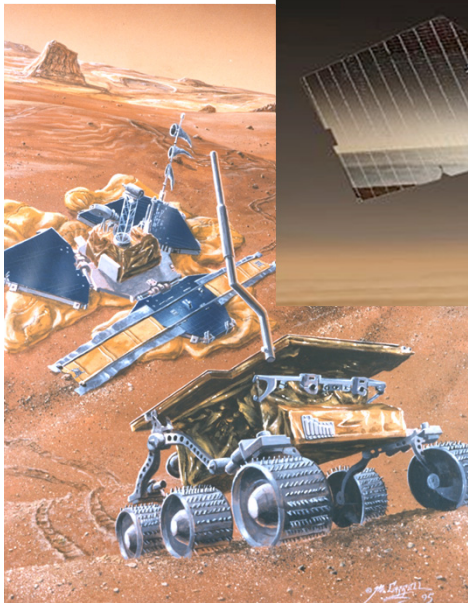
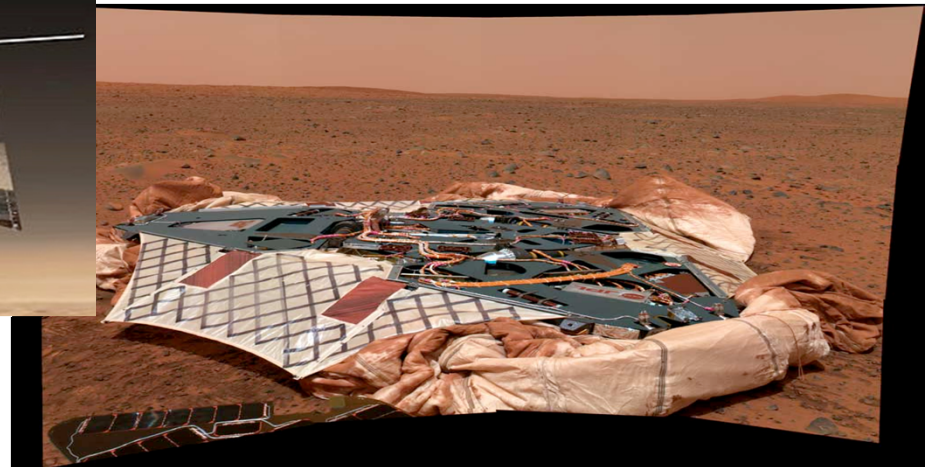
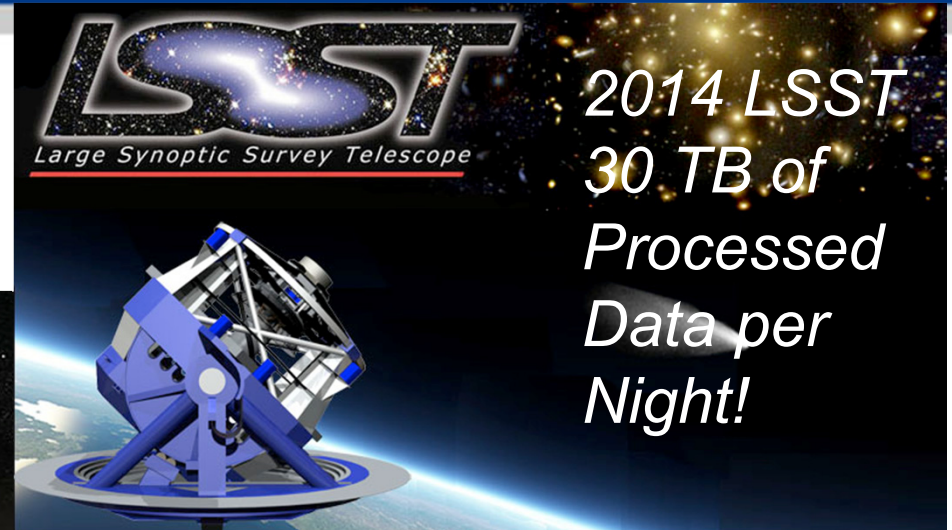




# *Trend 8. Big Data*



## JPL Missions Produce More Data



# Big Data Revolution

- Yesterday's MB is today's GB is tomorrow's YB
- 50% of orgs will replace DW platform by 2012 (source: DWI)
- Google Big Table has PBs of data on several 100,000 nodes
- Facebook-developed Cassandra database >40B pictures
- Amazon 2D, EBS, Simple DB used by Netflix with >1B rows
- Microsoft's HPC accessed from Excel
- Hadoop and MapReduce vs. established MPP/database
- Hadoop Pig: a SQL like I/F on top of big data for ease of use
- In Memory Analysis and In-Database Modeling will deliver orders of magnitude speed improvements. Customers will influence new vendor partnerships!
- Statisticians become cool with Big Predictive Analytics
- Rethink your data collection / access / computation / storage, distribution / visualization. Think BIG



# Trend 9. Human Behavior Considerations

*Are 140 characters sufficient  
for communication? (1)*

*How many identities did I have as a child?  
How many do I have now? (1)*

*Life in the cloud.*

*Do I need an umbrella? (2)*

*Gloomy Gus may not care about  
the environment, but he cares  
about battery life. (3)*

*And the password is...p-a-s-s-w-o-r-d (4)*

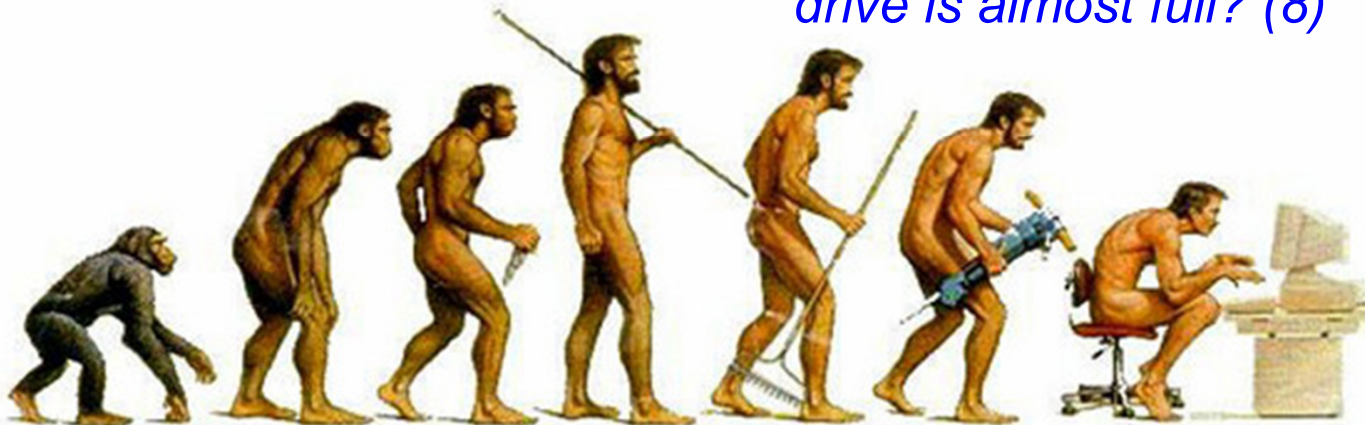
*A Nigerian Prince needs my help? (4)*

*Wait 30 seconds and it will be  
on sale, wait 30 days and it will  
be obsolete. (5)*

*Yep, there's even an app for that! (6)*

*Ooh, I can touch the screen? (7)*

*What do you mean my hard  
drive is almost full? (8)*

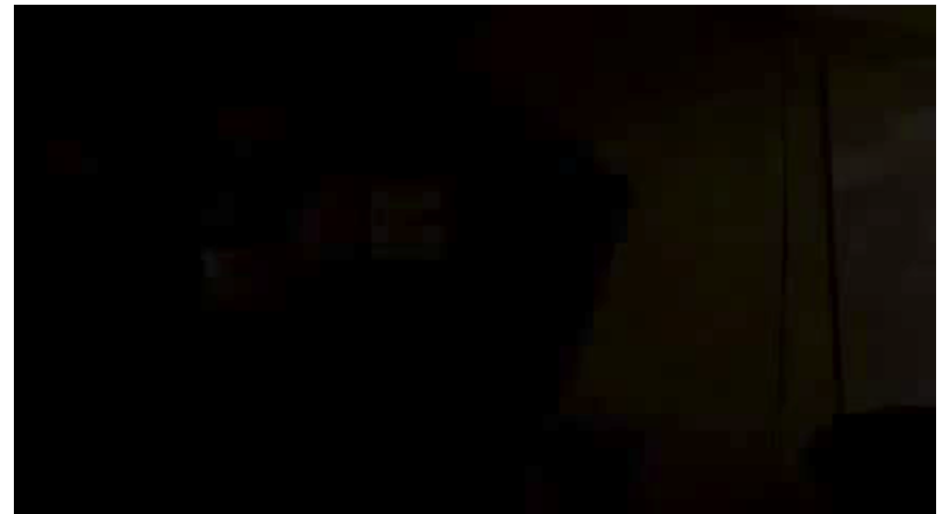


## Trend 9. Changing Human Behavior... Is this our future?



*Our Future: MIT Media Lab on TED*

# Is this our future?



MIT's "Develop a Sixth Sense:" <http://www.youtube.com/watch?v=bIBohrmyo-I>

# Early Examples of Changing Human Behavior

- Search Differently: <http://www.wolframalpha.com>
- Get help instantly: <http://siri.com/>
- Organize differently: <http://www.flipboard.com/>
- Do you know (yet): <http://www.youtube.com/watch?v=6ILQrUrEWe8>
- Order pizza differently: <http://www.youtube.com/watch?v=RNJI9EEcsoE>
- Kevin Kelly's future: <http://www.boingboing.net/2008/11/14/kevin-kelly-on-web-1.html>
- Social media: [http://www.linkedin.com/mbox?displayMBoxItem=&itemID=I2389172935\\_2&trk=COMM\\_NI](http://www.linkedin.com/mbox?displayMBoxItem=&itemID=I2389172935_2&trk=COMM_NI)
- Develop a Sixth Sense: <http://www.youtube.com/watch?v=bIBohrmyo-I>

Continue the conversation with us:

<http://www.meritalk.com/blog.php?user=TomSoderstrom> <http://tinyurl.com/JPL2011ITTrends>



or





# The Future IT: Innovating Together

End-user **and** mission focused. Open. Collaborative  
Expert IT consultants who enable.

World class futurists who know about and try  
new things quickly and bring innovative,  
lasting ideas.

*and who*  
*Proactively enables*  
*working with anyone*  
*from anywhere*  
*on any data*  
*using any device*

# A view from your great grandchildren's porch on Mars

